Functional Futbol: Functional Rehab Considerations For Elite Level Soccer Players

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Objectives

- To understand the physical demands on elite level soccer players, and corresponding musculoskeletal injuries
- To be able to identify mechanical flaws in sport specific movements that predispose to increased injury rates
- To implement functional therapeutic exercises into a plan of care, to identify readiness to return to play with decreased risk of re-injury

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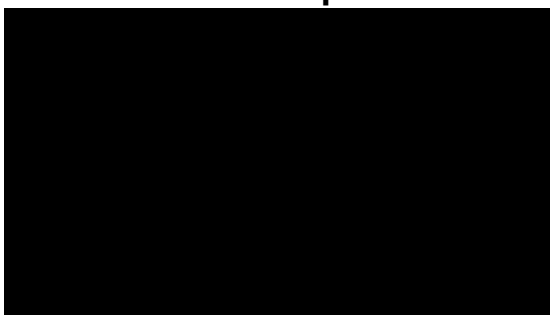
Goalkeeper



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Defenders (center back, outside back/wing back)

[redacted]

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Midfielders (center mids, outside mids/wing)

[redacted]

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Striker, center forward

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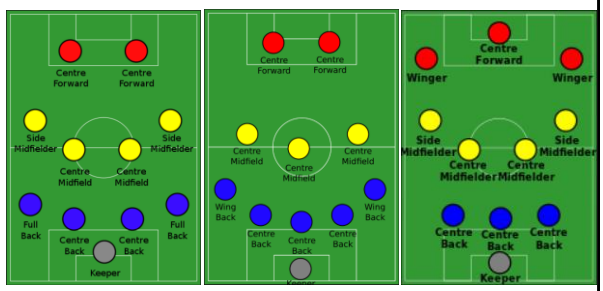
Common formations and variations



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Positional physical demands

- **Total distance covered:** Outside midfielders>center attacking midfielders>central defensive midfielders
- **Greatest distance sprinting** = forwards
- **Least distance sprinting** = center backs
- **Highest percent duels won** = Center backs and outside backs
- **Lowest percent duals won** = forwards

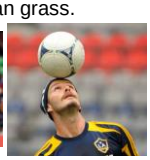
Important subjective information

- Sport specific task that increase pain
- Previous injuries and similarities
- Skill level
- Plant leg vs kicking leg
- Position
- Frequency of play

Extrinsic risk factors

- **Level of competition**:
  Match play injuries > practice/training injuries
- **Skill level**: Low skill level (younger players) 2x greater injury risk than skilled players.
- **Playing surface**: Artificial turf 2x greater than grass.



Intrinsic risk factors

- **Age**: In a review on current literature 6 studies found increased injury risk to older athletes, and 2 studies found increased injury risk with younger athletes.
- **Sex**: female athletes > risk for knee injuries; ankle/ lower leg?
- **Previous injury**: inadequate rehab following a previous injury ↑ injury risk, especially for the ankle and knee.

Intrinsic risk factors

- **Aerobic fitness**: poor physical condition = fatigue leading to ↓ in protective effect of musculature on skeletal structures
- **Joint laxity**: increased joint laxity has shown to be a risk factor for knee injuries, but not for ankle injury
- **Flexibility**: muscle tightness, specifically the iliopsoas ↑ risk of over use knee injuries in males
- **Anatomical alignment**: reduced femoral intercondylar notch width is a risk factor for ACL injury (non-contact)

Let's kick it!

Phase	Start	End
Preparation	Heel strike of kicking leg	Toe off of kicking leg
Back swing	Toe off of kicking leg	Max hip extension
Leg cocking	Max hip extension	Max knee flexion
Acceleration	Max knee flexion	Ball impact
Follow through	Ball impact	Toe speed inflection

Kicking biomechanics – Backswing

- Proximal to distal sequencing
- Hip extends up to 29 degrees as it adducts and externally rotates.
- The knee flexes and internally rotates
- The ankle is plantar flexed, abducted and slightly pronated.

Kicking biomechanics – Forward motion

- Initiated by rotating the pelvis around the plant leg
- Bring the thigh forward as the knee continues to flex
- Hip then begins to flex and abducts as it remains externally rotated
- The knee simultaneously extends

Kicking biomechanics

Muscle activation during kick

- **Thigh acceleration**: Rectus femoris and hamstring
- **Lower leg acceleration**: knee extensors
- **Lower leg deceleration**: hamstring and gastrocnemius
- Due to the position of the hip and knee in the back swing, the hamstrings exert more torque around the knee than the hip

Muscle activation during kick

- **Kick initiation**: iliopsoas
- **Immediately before ball contact**: biceps femoris and gluteus maximus
- **Kicking speed**: rapid knee flexion and extension + knee extensor stretch followed by immediate shortening
- **Skilled players**: ↑ activation of agonist muscles
  ↓ activation of antagonist muscles during swing phase

Foot mechanics at ball contact

- Ball speed = velocity of foot at impact
- Contact point closer to the ankle = rigid contact surface
- This is more effective than a contact point closer to the metatarsals

Kicking for accuracy vs. power

- Smaller target shooting: ↓ ball speed, ↓ linear and angular joint velocities
- These changes are accompanied with ↓ ROM of pelvis, hip and knee joints through the kick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Common kicking errors

- Approach speed
- Contact point on the ball
- Direction of forces applied to the ball
- Placement of plant leg
- Not locking your ankle to create rigid striking surface
- Improper body angle

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Plant leg vs kicking leg

- Females soccer players > trunk lean and lower leg angle on their plant leg = ↑ mediolateral ground reaction forces
- ↑ ground reaction forces with a more extended knee ↑ risk of ACL injury
- ↑ approach angle on a kick = ↑ ground reaction forces on the plant leg
- ↑ activation of knee flexors, hip extensors and hip abductors seen in the plant leg

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Plant leg vs kicking leg

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Injury prevalence

- Injury Patterns among Elite Football Players: A Media-based Analysis over 6 Seasons with Emphasis on Playing Position
  - 37.8% of injuries occurred during matches, and 62.2% occurred during training
  - **Injury type and localization:** 30.3% muscle injury, 16.7% joint/ligament, 8.5% contusion, 6.1% tendon injury
  - **Playing positions:** outside midfielders sustained the highest amount of match injuries
  - **Injury severity:** Mini(1-3 days) 5.8%, Mild (4-7 days) 18.5%, Mod (8-28 days) 39.5%, Severe (>28 days) 36.2%

Injury prevalence

Table 1 Injury pattern by type localization and severity.

	Total injuries			
Injury Type	**N Injuries (%)**	**Days Missed M (IQR)**	**Matches Missed M (IQR)**	**IR per 100 PS (95% CI)**
Fracture S	23 (0.7)	58 (42–71.5)	8 (5.5–11)	0.67 (0.43–1.01)
Fracture T	180 (5.4)	30 (13.5–68.5)	4 (2–9)	5.29 (4.54–6.12)
Joint/Lige	561 (16.7)	39 (15–75)	5 (2–12)	16.49 (15.16–17.92)
Menis/C	113 (3.4)	92 (41–144)	10 (5–18)	3.32 (2.73–3.99)
Contusions	216 (6.4)	7 (4–13)	1 (1–3)	6.35 (5.55–7.25)
Muscle	**1 016 (30.3)**	**15 (8–28)**	**2.5 (1–5)**	**29.87 (28.06–31.77)**
Tendon	159 (4.7)	31 (12.5–72.5)	5 (2–9)	4.67 (3.97–5.46)
CNS/PNS	36 (1.1)	7 (4.5–13)	2 (1–5)	1.05 (0.74–1.46)
Unknown	1 054 (31.4)	13 (6–41)	2 (1–6)	30.99 (29.15–32.92)
Total:	3 358 (100)	18 (8–63)	3 (1–6)	98.73 (95.42–102.13)
Common Injuries:				
Knee	77	191 (154–222)	23 (16–37)	2.26 (1.79–2.83)
Cruciate L				
Knee CL	105	42 (21–59)	5 (2–9)	3.09 (2.52–3.74)
Hip/Add	380	10 (6–22)	2 (1–4)	11.17 (10.08–12.35)
Ankle Sprain	296	29 (14–45)	4 (2–7)	8.70 (7.74–9.73)
Achilles Tear	69	29 (9.5–63)	4.5 (2–9)	2.21 (1.58–2.57)
Injury location				
Head/Neck	103 (3.1)	10 (6–17)	2 (1–3)	3.02 (2.47–3.67)
Upper–limbs	165 (4.9)	21 (11–42)	4 (2–6)	4.85 (4.14–5.65)
Trunk	188 (5.6)	13 (6–33)	2 (1–5)	5.52 (4.76–6.37)
Buttock	175 (5.2)	12 (5–40)	2 (1–4)	5.14 (4.46–5.96)
Hip/Groin	161 (4.8)	20 (7–55)	3 (1–7)	4.73 (4.03–5.52)
Thigh	410 (12.2)	10 (5–18)	2 (1–4)	12.05 (10.91–13.28)
Knee	**548 (16.3)**	**43 (13–95.5)**	**5.5 (2–14)**	**16.11 (14.79–17.52)**
Lower–legA	183 (5.4)	14 (2–46.5)	3 (0–7)	5.38 (4.62–6.22)
Ankle	323 (9.6)	18 (1–43)	3 (0–6)	9.49 (8.48–10.59)
Foot/Toe	178 (5.3)	26 (1–75)	4 (1–9)	5.23 (4.49–6.06)
Unknown	924 (27.5)	15 (7–31.25)	3 (1–5)	27.17 (25.44–28.97)
Injury Severity				
Mini (1–3 d)	196 (5.8)	3 (2–3)	1 (0–1)	5.76 (4.98–6.59)
Mild (4–7 d)	621 (18.5)	5 (4–7)	1 (1–2)	18.26 (16.85–19.75)
Mod (8–28 d)	1 327 (39.5)	14 (11–20.5)	2 (2–4)	39.02 (36.94–41.17)
Sev (>28 d)	1 214 (36.2)	60 (40–103)	8 (5–15)	35.68 (33.71–37.76)

Injury prevalence

Table 2 Injury incidence for the different playing positions.

	Match Injuries				
	Injuries (%)	**Exposure (MH)**	**IR (95% CI)**	**IRR (95% CI)**	**p-value**
Goalkeepers	75 (5.9)	10 992	6.82 (5.36–8.55)	0.63 (0.49–0.82)	<0.001
Central Defenders	278 (21.9)	22 275	12.48 (11.05–14.04)	1.16 (0.97–1.40)	0.099
Wing Defenders	174 (13.7)	16 982	10.24 (8.78–11.88)	0.97 (0.79–1.19)	0.756
Central Midfielders	358 (28.2)	29 429	12.16 (10.93–13.49)	1.09 (0.92–1.30)	0.309
Wing Midfielders	183 (14.4)	14 185	12.90 (11.10–14.91)	1.10 (0.90–1.34)	0.356
Forwards	202 (15.9)	16 354	12.35 (10.70–14.18)	1.00 (reference)	

IR = Incidence rate; MH = Match hours; PS = Player-season; CI = Confidence Interval; IRR = Incidence Rate Ratio

	Training Injuries			
Injuries (%)	**Exposure (PS)**	**IR (95% CI)**	**IRR (95% CI)**	**p-value**
163 (7.8)	386	42.22 (35.99–49.23)	0.73 (0.61–0.88)	0.001
410 (19.7)	626	65.49 (59.30–72.15)	1.08 (0.94–1.25)	0.283
289 (13.8)	493	58.62 (52.05–65.78)	0.98 (0.83–1.14)	0.763
579 (27.7)	896	64.62 (59.46–70.10)	1.07 (0.94–1.22)	0.326
298 (14.3)	464	64.22 (57.13–71.94)	1.03 (0.88–1.20)	0.723
348 (16.7)	536	64.92 (58.28–72.11)	1.00 (reference)	

Injury prevalence

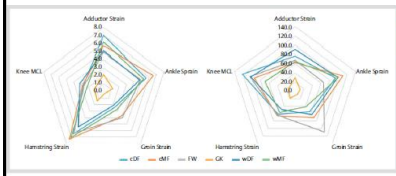
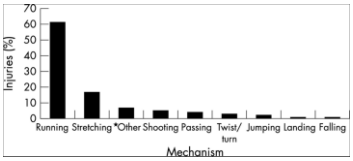


Fig. 1 Injury profiles of positional roles. Left panel illustrates the injury incidence (per 100 player seasons). Right panel illustrates the injury burden (days missed/100 player-seasons)

Hamstring strains



- 7% of hamstring strains are caused by player to player contact
- 57% of hamstring injuries were sustained during running
- Rate of hamstring strains by position
  - 40% Defenders
  - 30% Midfielders
  - 25% Attackers
  - 3% Goalkeepers

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Hamstring strains

- **Running cycle**: injury occurs during the end of the swing phase, and late stance phase
- **End of swing phase**: the hamstring is decelerating the limb while simultaneously controlling knee extension.
- The hamstring must change rapidly from eccentrically decelerating knee extension, to concentrically extending the hip.



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Ankle sprains

- Goalkeepers: 79% are a result of non-contact situations
- Field players: 59% occur with player contact
- A laterally directed force to medial aspect of lower leg just before foot strike is commonly seen with inversion ankle sprains
  - The injury becomes more severe if the foot is planted and weight bearing



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Ankle bracing

- Ankle bracing ↓ re-injury in soccer players with previous history of ankle injury.
- Bracing didn't make a difference in players without a previous history of ankle injury.
- Bracing and proprioceptive disk training both display reduction of incidence rate for ankle sprains.


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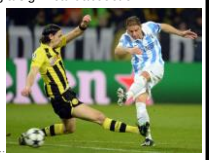
Adductor strains

- Primary function: adduct the thigh in open chain, and stabilization of the pelvis/lower extremity in a closed chain
- Eccentric adductor tension is greatest with the leg abducted and externally rotated
- Typical mechanism for injury:
  - pushing off in opposite direction
  - Kicking a ball with the inside of the foot, and meeting a significant abduction force





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Athletic Pubalgia (Sports Hernia)

- Occurs with weakening of
  - Rectus abdominis
  - Pyramidalis
  - Internal and external obliques
  - Transverse abdominis

- Pain ↑ with twisting/turning during single limb stance, and physical exertion that ↑ intra-abdominal pressure
- Difficult to pinpoint pain, and can radiate to adductors
- Anatomical predisposition: ↑ anterior pelvic tilt and/or internal rotation of ilium

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Functional rehab considerations

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Questions?

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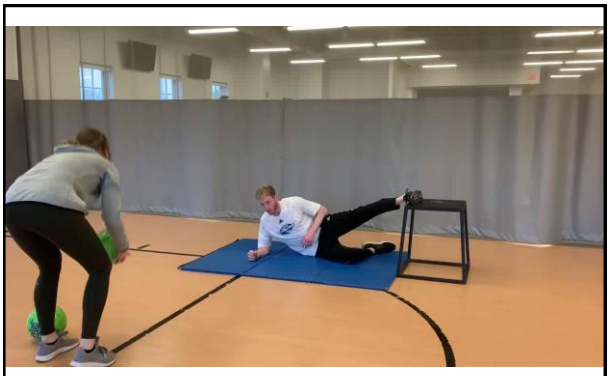

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